SRYAHWA PUBLICATIONS

Annals of Ecology and Environmental Science
ISSN: 2637-5338 | Volume 7, Issue 2, 2025
https://doi.org/10.22259/2637-5338.0702001

RESEARCH ARTICLE

Structure and Dendrometric Characteristics of *Anacardium Occidentale* L. Plantations Based on Harvesting Methods in the South Sudanian Zone of Burkina Faso

NOMBRÉ Sébastien Ange Habih[1], NOMBRÉ Issa[1,2], SEMDÉ Zénabou[4], DAO Madjelia Cangré Ebou[3], Boussim Issaka Joseph[1], NOMBRÉ Eloi Jean Prosper[5]

[1]*Laboratoire de Biologie et Écologie Végétales, Université Joseph KI-ZERBO 03 BP 7021 Ouagadougou 03,Burkina Faso.*

[2]*Institut des sciences et technologie, École Normale Supérieure 01 BP 1757 Ouagadougou 01, Burkina Faso.*

[3]*Institut de l'Environnement et de Recherches Agricoles, Centre Nationale de Recherche en Sciences et Technologie 03 BP 7047 Ouagadougou 03, Burkina Faso.*

[4]*Institut de Recherche en Sciences Appliquées et Technologies, Centre Nationale de Recherche en Sciences et Technologie 03 BP 7021 Ouagadougou 03, Burkina Faso.*

[5] *Fédération Nationale des Producteurs d'Anacarde du Burkina S/C BP 80 Batié/Province du Noumbiel.*

Received: 18 November 2025 Accepted: 08 December 2025 Published: 17 December 2025

Corresponding Author: NOMBRÉ Sébastien Ange Habih, Laboratoire de Biologie et Écologie Végétales, Université Joseph KI-ZERBO 03 BP 7021 Ouagadougou 03, Burkina Faso.

Abstract

Cashew cultivation plays a key role in the socio-economic developement of local communities. It is both an ecologically and socially transitional crop, yet its cultivation remains poorly understood. This study aims to provide esential information to support the sustainable developement of cashew production. The methodological involved phytosociological inventories conducted in two farming systems: agroecsystems with crop association, where we established plots of 50 m x 50 m plots were established, and agroecosytems without crop association, where we established plots of 50 m x 20 m plots were set up for adult woody species (diameter at 130 cm ≥ 5 cm). Tree height and diameter at 130 cm above ground were measured. This was supplemented by visual observations.

Results: The findings show that tree density varies according to the management system, with 77.81 ± 37.59 (individuals/ha) in the agroecosystems with crop association and 163 ± 61.49 (individuals/ha) in agroecosystems without crop association. The average diameter at 130 above ground was 16.70 ± 9.33 (cm) in agroecsystems with crop association and 23.53 ± 9.24 (cm) in agroecosytems without crop association.

Conclusion: Enhancing producers' technical capacity and improving disease control are essential for sustainable development of the cashew sector.

Keywords: Cashew, Agroforestry, Management, Burkina Faso.

1. Introduction

Cashew (*Anacardium occidentale L.*) is a crop of major socio-economic importance in Burkina Faso. This importance is evident in the extent of the land devoted to it, which represents 70.2% of total area used for fruit crops (MAH, 2011). This expansion is explained by the attractive international price of cashew nuts and kernels (Tarpaga *et al.*, 2020). Today, the cashew industry is one of Burkina Faso's main assets for economic development.

Citation: NOMBRÉ Sébastien Ange Habih, NOMBRÉ Issa, SEMDÉ Zénabou *et.al*. Structure and Dendrometric Characteristics of *Anacardium Occidentale* L. Plantations Based on Harvesting Methods in the South Sudanian Zone of Burkina Faso. Annals of Ecology and Environmental Science. 2025; 7(2): 01-09.

In addition to its economic benefits, cashew also plays an important ecological role. When integrated into agroforestry systems, it contributes to the restoration of degraded land, reforestation of agricultural zones (Yoni *et al.*, 2023 ; Ndiaye ,2024). Numerous studies have been conducted on this species in Burkina Faso, focusing on various aspects such as the socio-economic importance of its production (Somé, 2014, Dao *et al.*, 2022,), the agro-morphological characterization of high-yielding varieties (Tarpaga *et al.*,2020), and the ecosystem services provided by cashew-based agroforestry parks (Yoni *et al.*,2023).

However, despite this growing interest, knowledge of the environmental effects of cashew orchards particularly their effects on biodiversity remains limited and fragmented(Samb *et al.*, 2024). In addition, cropping systems are highly heterogeneous, reflecting a diversity of agricultural practices, including agrosystems with crop associations and those without. These practices significantly influence stand structure, associated floristic composition, and tree dendrometric characteristics (Pindi *et al.*, 2019; Kengne *et al.*, 2024).

Analysis parameters such as density, total height, diameter at 130 cm above ground level, and spatial distribution is essential for assessing the productivity, sustainability and ecosystem services provided by cashew orchards (Sierra-Baquero et al., 2024 ; Sanoko *et al.*, 2025).

This is the background to the present study, which aims to characterize the structure and dendrometric parameters of cashew orchards under different farming practices.

The aim is to gain a better understanding of the impact of these farming methods on cashew stand dynamics, in order to inform sustainable management and agricultural intensification strategies. Specifically, we aim to: (i) characterize the structure and dendrometric parameters of orchards based on the type of farming, and(ii) study plant diversity within these agrosystems.

2. Materials and Methods

2.1 Study Area

The present study was carried out in the villages of Pima and Boborola, located in the rural commune of Sidéradougou, Comoé province, Cascades region (Figure1). The commune is situated between latitudes 10°32’ and 11°03’ north, and longitudes 4°00’ and 4°37’ west. It lies within the South Sudanian phytogeographical sector (Fontes and Guinko, 1995). The climate is characterized by two alternating seasons: a rainy season from May to September, and a dry season from October to April. Average annual temperatures range from 17°C to 36°C. Natural vegetation consists of savannas (trees, shrubs) and gallery forests (Fontes and Guinko, 1995). The main soil types are ferruginous, leached or slightly leached, and are found on sandy, sandy-clay and silty-clay substrates (BUNASOL, 1985).

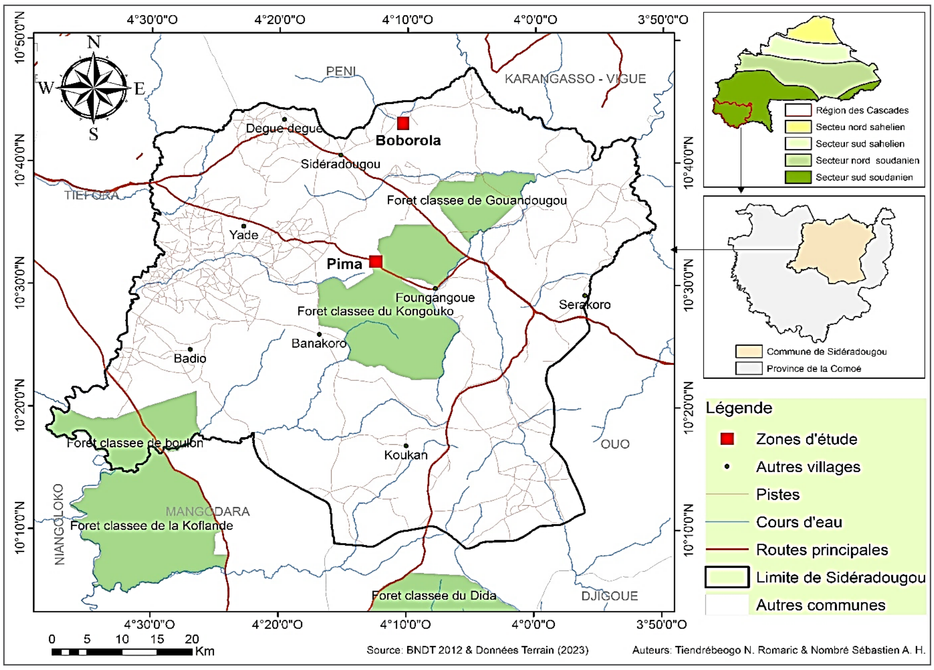

Figure 1. *Localization of the study areas.*

2.2 Sampling and Data Collection

To assess the structure of cashew orchards and the associated floristic diversity, a systematic inventory of woody vegetation was carried out in two types of agrosystems: (agrosystems without crop association and agrosystems with crop association). The sampling unit consisted of rectangular plots (Samb et al., 2024) of 1000 m^2 (50 m*20m) for agrosystems without crop association and the square plot (Thiombiano et al., 2016) of 2500 m^2 (50 m*50 m), spaced at 25 meter intervals (Samb et al.,2024).

In each plot, dendrometric data were collected for all trees with a diameter greater than or equal to 5 cm. Diameters was measured at 20 cm and 130 cm above ground level using a flexible measuring tape. For each tree, the following data were recorded: species name, total height, number of stems (for multi-stemmed trees) and crown diameters in two orientations (east-west and north-south), specifically for cashew trees.

2.3 Data Processing and Analysis

2.3.1 Calculation of Diversity Parameters

Data were entered into Excel spreadsheets. The diversity parameters considered were included species richness (R), Shannon's diversity index (H', in bits), and Pielou's evenness index (J').

- Specific richness corresponds to the number of woody species recorded per sampling plot.
- The Shannon index (H') is calculated using the following formula.

$$H' = -\sum_{i=1}^{S} Pi ln Pi$$

where S is species richness, pi = relative abundance of the ith species in a given plot. The value of H' = 0 if all individuals in the stand belong to one and the same species; H' < 2.5: if low diversity; 2.5 ≤ H' < 4: medium diversity and H' ≥ 4: high diversity.

The maximum theoretical Shannon-Weaver diversity index (H'max) is calculated as.

H' max= log (S), where S is the total number of species in the plot.

- Pielou's evenness index (J') (Pielou, 1966) was used to estimate the uniformity of species abundances distribution. It is the ratio of the observed diversity to the maximum possible diversity and reflects how evenly individuals are distributed among species. The value of the J' ranges from 0 to 1. It tends towards 0 when there is dominance, and towards 1 when the distribution of individuals between species is regular.

$$J' = \frac{H'}{H'max}$$

2.4 Determination of Structural Parameters

The structural parameters considered in this study were mean diameter, mean height, mean density, and basal area. The mean diameter at 130 cm (Dm 130 cm) of multicaulus individuals was calculated using the following formula.

$$Dm\ 130\ cm = \frac{\sum_{i=1}^{n} di}{N}$$

where di represents the diameter of the tree and N the total number of individuals of the species. The quadratic diameter was calculated for multicaulus individuals using the following formula.

$$D130\ cm = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(D130\ cm)^2}$$

Density (D) by the formula.

$$D = \frac{N}{S},$$

The basal area (G) is the sum of the cross-sectional areas in m² of all trees with diameters (measured at 20 cm and 1.30 m above ground level) of at least 5 cm, and is expressed per hectare. It was calculated as.

$$G = \pi \times \left(\frac{Di^2}{4}\right) en\ m^2/ha$$

where Di is the diameter of the tree measured at 20 cm or at 1.30 m above ground.

According to Rondeux (1999), grouping stems into height classes is highly relevant in forest management, as it reflects the structure of a stand. Cashew tree populations were thus divided into height classes with 2 meter intervals.

For the analysis of diameter structure, trees were grouped into diameter classes with 5 centimeter intervals. The resulting histograms were fitted to the 3-parameter Weibull distribution (parameters a, b and c). This distribution, widely used in forestery studies, is known for its flexibility (Johnson and Kotz, 1970). Its probability density function is defined as follows (Rondeux, 1999).

$$F(x) = \frac{c}{b}\left(\frac{x-a}{b}\right)^{c-1} e^{-}\left(\frac{x-a}{b}\right)$$

where x is the tree diameter; a is the position parameter (minimum measured diameter threshold); b is the scale or size parameter, linked to the central value of tree diameters in the stand under consideration; c is the shape parameter linked to the diameter structure under consideration.

2.5 Statistical Analysis

All statistical analyses were performed using R software (version 4.5.1). Analysis of variance (ANOVA) was conducted to compare the means of the various parameters measured between the different types of agroesystems.

Differences were considered statistically significant at $p< 0.05$ and highly significant at $p < 0.01$.

3. Results

3.1 Dendrometric Stand Parameters by Harvesting Method

The main dendrometric characteristics of *Anacardium occidentale* stands vary depending on the type of agroesystem (Table 1).

The average height of cashew trees ranged from 4.68±1.99 m in agroecosystems with crop associations to 5.45±2.05 m in those without. Similarly, the average diameter at breast height (DBH) was significantly greater in agroecosystems without crop associations (23.53±9.24 cm) compared to those with associations (16.7±9.24 cm). An analysis of variance (ANOVA) indicated that these differences were statistically significant for both height and diameter ($P < 0.05$).

The Average crown diameter ranged from 3.44±1.35 m in agroecosystems with crop <associations to 4.06±1.4 m in those without. In contrast, the average spacing beteween individuals was higher in agroecosystems with crop associations (10.99±2.63 m), reflecting a lower stand density in these systems.

Table 1. *Dendometric parameters of cashew trees stands by farming*

Farming system	Agroecosystem with crop association	Agroecosystem without crop association
Tree height (m)	4.68 ± 1,99 ^{a}	5.45 ± 2.05 ^{b}
Diameter (cm)	16.7 ± 9,33 ^{a}	23.53 ± 9.24 ^{b}
Average crown diameter (m)	3.44 ± 1,35	4.06 ± 1.4
Average tree spacing (m)	10.99 ± 2.63	6.07 ± 1.17

Different letters indicate significant differences at $P < 0.05$.

3.2 Wood Diversity Assessment

3.2.1 Diversity and Composition according to Farming Method

The floristic inventory identified 23 species belonging 19 genera, grouped into 12 families. Species distribution varied by farming system, with 16 species recorded in agroecoecosystems with crop association and 18 species in those without. These species were distributed among 13 and 15 genera and included in 9 and 10 families respectively, following the succession patterns of each farming method. In agroecosystems with crop association, the most repersented families were Anacardiaceae (76.16%), Sapotaceae (12.69%) and Fabaceae (5.57%). In agroecosystems without crop association, Anacardiaceae (80.07%), Sapotaceae (10.95%) and Fabaceae (6.70%) were also the dominant families.

The Shannon diversity index (H') ranged from 0.64±0.45 in agroecosystems with crop associations to 0.53±0.27 in those with crops. These values reflect low diversity in both environments. The values of Piélou's equitability index for the two farming systems reflect dominance in species distribution. The observed regeneration rates further indicate poor natural regeneration in both environnements.

Table 2. *List of plant species associated with cashew trees (%)*

Species	Agroecosystem with crop association (%)	Agroecosystem without crop association (%)
Anacardium occidentale L.	75.54	80.07
Burkea africana Hook. F.	0.31	0.49
Cassia sieberiana DC.		0.16
Daniellia oliveri (Rolfe) Hutch. & Dalz.	0.93	0.33
Dichrostachys cinerea (L.) Wight & Arn.	-	0.33
Diospyros mespiliformis Hochst. Ex A. Rich.	1.24	0.16
Ficus glumosa Del.	0.62	0.16
Ficus sur Forssk.	1.24	0.16
Ficus sycomorus ssp. gnaphalocarpa (Miq.) C. C. Berg	-	0.33
Ficus thonningii Blume	0.62	-
Grewia flavescens Juss.	0,93	0.33
Holarrhena floribunda (G. Don) Dur. & Schinz	0.31	-

Khaya senegalensis (Desr.) A. Juss.	-	0.16
Lannea acida A. Rich	0.62	-
Lophira lanceolata Van Tiegh. ex Keay	0.31	-
Manilkara multinervis (Bak.) Dubard	0.93	-
Moringa oleifera Lam.	0.31	0.65
Parkia biglobosa (Jacq.) R. Br. Ex G. Don	4.33	4.74
Piliostigma thonningii (Schumach.) Milne-Redh.	-	0.33
Securidaca longipedunculata Fres.	-	0.16
Tamarindus indica L.	-	0.33
Terminalia laxiflora Engl.	-	0.16
Vitellaria paradoxa Gaertn. F.	11.76	10.95

Table 3. *Variation in diversity according to farming system*

Farming system	Agroecosystem with crop association	Agroecosystem without crop association
Number of species	16	18
Number of genera	13	15
Number of families	9	10
Regeneration rate (%)	22.5	13.04
Shannon diversity index (H', bits)	0.64 ± 0.45	0.53 ± 0.27
Pielou's evenness index J'	0.57 ± 0.17	0.49 ± 0.16

3.3 Plantation Characteristics

3.3.1 Density Indices and Quality Parameters

Density indices and quality parameters vary depending on the type of agroecosystem (Table 4). The average tree density is significantly higher in agroecosystems without crop association (163 ± 61.49 individuals.ha^{-1}) than in those with crop association (77.81 ± 37.59 individuals.ha^{-1}). This difference is also reflected in basal area, which is significantly greater in agroecosystems without crop associations (8.15 ± 4.87 m^2.ha^{-1}) compared to those without crop associations (2.3 ± 2.88 m^2.ha^{-1}). The stability index was slightly higher in agroecosystems with crop associations (28.02). However, the spacing factor, an indicator of spatial competition between trees, was also higher in agrosystems with crop associations (2.44), reflecting greater inter-individual distances and, potentially, reduced competition.

Finally, the slenderness coefficient factor (F), an indicator of the vertical morphology of trees, showed higher values in agroecosystems with crop associations (26.95).

Table 4. *Variation in tree density and structural quality parameters by farming system*

Farming system	Agroecosystem with crop association	Agroecosystem without crop association
Density (individuals. ha^{-1})	77.81 ± 37.59 ^{a}	163 ± 61.49 ^{b}
Basal area (m^2. ha^{-1})	2.3 ± 2.88 ^{a}	8.15 ± 4.87 ^{b}
Stability index	28.02	23.16
Spacing factor (S)	2.44	1.34
Slenderness coefficient (F)	26.95	19.12

Means followed by different letters on the same row are significantly different at the 0.05 significance level according to ANOVA.

3.4 Horizontal and Vertical Planting Distribution

The data presented in figures (2&3) show that the diameter class distribution of *Anacardium occcidentale* individuals varies according to the farming system. In agroecosystems with crop association, the [10-15[and [15-20[diameter classes are the most represented, indicating a predominance of young to moderately mature individuals. Conversely, in agroecosystems without crop associations, the [20-25[and [25-30[classes account for the majority of individuals, suggesting a stand structure dominated by more mature trees.

In terms of height distribution (figure 4&5), a high concentration of individuals is observed in class [3.3-5.3[in agroecosystems with crop associations, whereas in agrosystems without crop associations, the [3.3-5.3[class is the most represented.

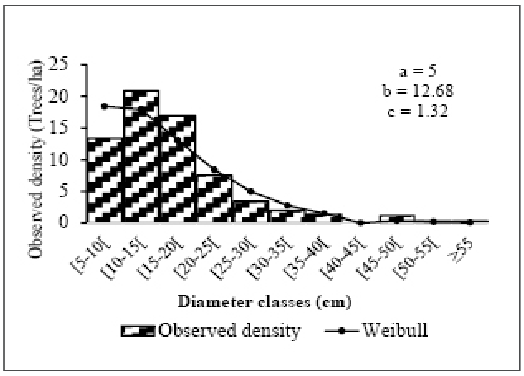

Figure 2. *Distribution of cashew trees by diameter class in agroecosystems with crop associations*

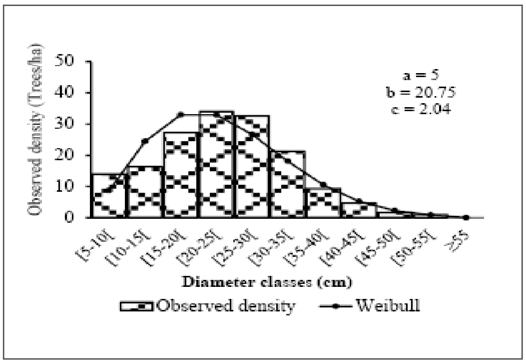

Figure 3. *Distribution of cashew trees by diameter class in agroecosystems without crop associations*

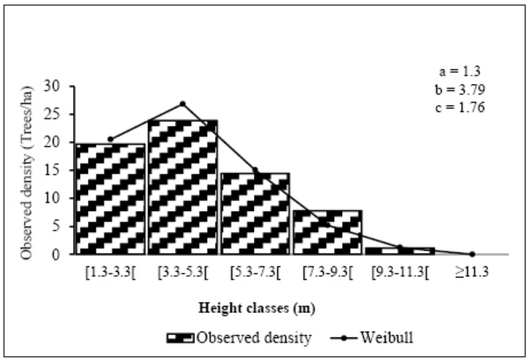

Figure 4. *Distribution of cashew trees by height class in agroecosystems with crop associations*

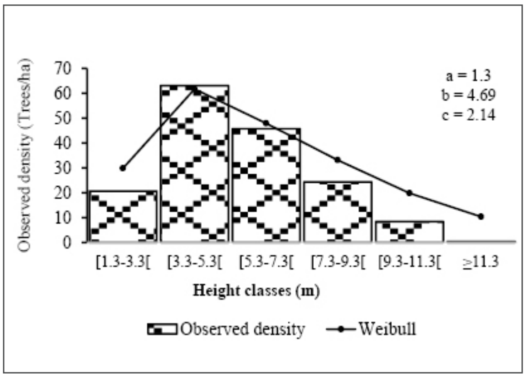

Figure 5. *Distribution of cashew trees by diameter class in agroecosystems without crop associations*

4. Discussion

4.1 Dendrometric Parameters of the Stand as Function of the Harvesting Method

The average height of cashew trees observed was 4.68 ± 1.99 m in agroecosystems with crop associations, compared with 5.45 ± 2.05 m in agroecosystems without crop associations. However, these averages mask a certain degree of variability, with minimum heights of 1.75 m and maximum heights of 12 m in some areas, and diameters ranging from 5.09 to 75 cm. Statistical analysis revealed a significant difference in tree height and diameter between the two types of farming systems. Our results are consistent with those reported by Samb *et al*., (2018), who obtained similar values in the Groundnut Basin in Senegal. They are also comparable to the findings of Yoni *et al*., (2023) in the Dindéresso classified forest in western Burkina Faso. The average diameter of cashew trees in plantations without crop association corroborates the values reported by Samb *et al*., (2017) in the Groundnut Basin, while the diameter recorded in agroecosystems with crop association is similar to that found by the same author in Casamance. According to Lautié *et al.* (2001), cashew trunk diameter can range between 1.2 and 1.5 m. The differences observed could be attributed to several factors, including soil characteristics, the cultivars used, and the production systems and techniques applied (Ndiaye *et al*., 2017). In addition, a significant difference in tree density was also observed between the two study environments. The density recorded in agroecosystems with crop association is comparable to that reported by Yoni *et al*., (2023) in the Dindéresso classified forest, in western Burkina. In contrast, the density observed in agroecosystems without crop association is similar to that reported by Ndiaye *et al*., (2017) in Casamance, Senegal. According to Goujon *et al*., (1973), an optimal density of 90-120 plants.ha^{-1}, with a spacing of between 9 and 12 meters, is recommended for healthy cashew tree development. Similarly, Badiane and Sy (2005) recommend an ideal density of 100 trees.ha-1 to ensure optimal crown development and soil cover. In our study, agroecosystems without crop associations exceeded the recommended thresholds, indicatin irregular stand structures in terms of both density ond vigor,as previously reported by Samb *et al.*, (2017). Elevated stand densities represent a constraint for effective plantation management. Stand density is a critical determinant of plantation dynamics and directly informs the implementation of silvicultural interventions (Samb *et al*., 2017). Nonetheless, the analysis of structural quality indices suggests that overall stand stability remains adequate. The slenderness factor, which characterizes plantation stability, shows low values in both environments. However, light thinning may be necessary to maintain or improve this stability, by limiting competition between individuals and slowing the increase in the slenderness factor. Depending on the extent to which competition is reduced, thinning can slow the progression of the slenderness factor (Perret and Ginisty, 2009).

4.2 Diversity and Floristic Composition of Cashew Plantations

The floristic inventory carried out in the two types of agroecosystems identified 23 species belonging to 19 genera. This number of species is lower than that reported by Samb *et al.*, (2024) in the department of Foundiougne in Senegal, but higher than that recorded by Ndiaye *et al*., (2017) in the rural commune of Djibanar,Senegal. This floristic variability from one site to another can be attributed to differences in ecological conditions, cultivation practices and anthropogenic pressure. Of particular interest are certain species such as Vitellaria paradoxa and Parkia biglobosa, which are found in high proportions in both agroecosystems. This dominance can be explained by the fact that these species are traditionally protected by producers for agricultural, pastoral and veterinary uses (Ndiaye et al., 2014; Ndiaye *et al*., 2017). Other species, on the other hand, are resticted to only one type of agroecosystem. This may be the result of a selective preservation during land clearing, with certain species being spared and maintained voluntarily because of their therapeutic, nutritional or economic value (Wala *et al.*, 2005). According to Soto-Pinto *et al.*, (2000), the intensification of practices within the agroforestry system, or if the farmer only allows the growth of a few species based on their economic value, results in a reduction in biodiversity.

Indeed, the low values of the Shannon indices in both environments indicate that all individuals belong to almost the same species. Similarly, Pielou's equitability index also reflects low diversity in both environments. This low floristic diversity could be attributed to deliberate choices by growers, who favor certain species of interest. This selective management pratice underlines the importance attached to the nutritional, medicinal, and economic values of certain species (Samb *et al.*, 2024). This trend also highlights the monospecific nature of cashew plantations, which naturally limits floristic diversity. However, the presence of associated woody vegetation, although not highly diverse, plays a crucial role in soil stabilization, preventing particle displacement, promoting soil fertility, and establishing a microclimate (Grouzis and Akpo, 1993). In addition, certain associated species contribute positively to cross-pollination within agroforestry systems. During the flowering period, they attract pollinators (bees, insects, birds, etc.) from which cashew trees also benefit, potentially improving their yield (Ndiaye *et al*., 2017).

5. Conclusion

This study, carried out in the Cascades region, characterized the structure and dendrometric parameters of cashew plantations according to the type of management. The results reveal variable stand densities, with agroecosystems involving crop associations exhibiting densities consistent with silvicultural recommendations, in contrast to those without associations, which are often overdense.

Structural analysis revealed the dominance of a shrub layer in type two agroecosystems. Stability indices indicate that plantations are stable overall.

In terms of flora, 23 species belonging 19 genera and 12 families were inventoried. The composition is dominated by *Anacardium occidentale*, followed by *Vitellaria paradoxa* and *Parkia biglobosa*, species often retained for their multiple uses. However, both environments show low species diversity, reflecting the monospecific nature of the plantations and the effects of management focused on economic productivity. These results underline the need to integrate sustainable management approaches that reconcile production with biodiversity conservation and maintenance of ecological functions, in order to ensure the long-term sustainability of cashew-based agroforestry systems.

Acknowledgements

The authors would like to thank the Fonds National de la Recherche et de l'Innovation pour le Développement (FONRID) and the Conseil Burkinabè de l'Anacarde (CBA) for their financial and material support of this study. Special thanks are also extended to the people of the Sidéradougou commune for their valuable assistance.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

6. References

1. Badiane, S., & Sy, P.B.A. (2005). *Manuel de sylviculture de l'anacardier.* Dakar, Sénégal, 30 p.
2. BUNASOL. (1985). *Etat de connaissances de la fertilité des sols du Burkina Faso*. Document technique n° 1. Ouagadougou (Burkina Faso).
3. Dao, A., Bationo, B. A., Traoré, S., Cissé, M., & Thiombiano, A. (2022). Déterminants biophysiques et socioéconomiques de la gestion des parcs à anacardiers (*Anacardium occidentale* L.) et à manguiers (*Mangifera indica* L.) en zone sud soudanienne du Burkina Faso (Afrique de l'Ouest). Sciences Naturelles et Appliquées. 4(2) : 137- 159.
4. Fontès, J., & Guinko, S. (1995). Carte de la végétation et de l'occupation du sol (Burkina Faso). Notice explicative. Laboratoire d'Écologie Terrestre, Institut de la Carte Internationale de la Végétation. CNRS, Université de Toulouse III (France)/Institut du Développement Rural, Faculté des Sciences et Techniques, Université de Ouagadougou, Burkina Faso.
5. Goujon, P., Lebfevre, A., Leturq, Ph., Marcellesi, A. P., & Praloran, J. C. (1973). Études sur l'anacardier. *Bois et Forêts des Tropiques,* 115, 27-53.
6. Kengne, C. O., Ibrahima, W. S., Mana, D., Wouokoue, T. B. J., Nazifou, S., Muting, D. T., Tchobsala, & Zapfack, L. (2024). Caractérisation écologique et gestion des peuplements arborés des agrosystèmes périurbains : cas des champs de cultures pluviales du Diamaré, Extrême-Nord Cameroun. *Journal of Animal &Plant Sciences.* 6(3) : 11277-11303.
7. Lautié, E., Dornier, M., De souza, F., & Reynes M. (2001). Les produits de l'anacardier : caractéristiques, voies de valorisation et marchés. *Fruits,* 56(4), 235-248.
8. Ministère de l'Agriculture et de l'Hydraulique. (2011). Rapport général du module arboriculture. P38.
9. Ndiaye, S., Charahabil, M.M., Ndiaye, O., & Malaïny, D. (2017). Influence de la flore ligneuse associée dans la production des parcs à *Anacardium occidentale* L. dans la communauté rurale de Djibanar (Casamance/ Sénégal). *Int. J. Biol. Chem. Sci*., 11 (2) :585-596.
10. Ndiaye, S. (2024). Flore ligneuse dans les agroforêts à base d'anacardier en Casamance (Sénégal). *Revue territoire environnement développement* (TED). 3 (2) : 62-71.
11. Perret, S., & Ginisty C. (2009). Jusqu'où dynamiser la sylviculture du pin sylvestre en région centre ? les enseignements issus du réseau expérimental du Cemagref. *Rendez-vous Techniques ONF*, n° 23-24, pp. 3-13.
12. Pindi, K. C., Avana-Tientcheu, A. L. M., Mananga, M. P., Muma, M. C., & Taffo, W. B. J. (2019). Systèmes agroforestier et conservation de la phytodiversité ligneuse dans la le paysage agraire du Territoire de Tshela / Kongo-Central en République Démocratique du Congo. *European Journal of Scientific Research*. 152 (3) : 322-333.
13. Rondeux, J. (1999). *La mesure des arbres et des peuplements forestiers*. Les presses Agronomiques de Gembloux, 2 e Edition. Gembloux : 521p.
14. Sanoko, F. K., Koffi, K. J-M., Coulibaly, F. L., Fondio, L., Adiko, Y. O., & Malezieux, É. (2025). Study of developement of cashew (*Anacardium occidentale*

L.) yield components at tree level in northern Côte d'Ivoire. *Annual Research & Review in Biology*. 40 (6): 72-81.

15. Sierra-Baquero, P., Catarino, S., Costa, G.J., Barai,, A., Correia, Z., Ferreira, M. R., Varón-Devia, E., Romeiras, M. M., Catarino, L., Duarte, M. C., & Monteiro, F. (2024). Insights into the cashew production system in Guinea –Bissau: Implication for *agroecosytem sustainability. Frontiers in Sustainable Food Systems.* 8 :1439820.
16. Somé, L. F. M. C. (2014). Analyse socio-économique des systèmes de production d'anacarde au Burkina Faso : cas des régions des Cascades et des Hauts-Bassins. Mémoire de master 2, Institut du développement rural, Université Polytechnique de Bobo-Dioulasso, Burkina Faso, 44 p.
17. Samb, C. O., Faye, E., Touré, M. A., Ba, H. S., Diallo, A. M., Sanogo, D., Badiane, S., & Samba, S. S. A. N. (2017). Typologie des plantations d'anacardier (*Anacardium occidentale* L.) dans deux zones agro-écologiques du Sénégal. Colloque International d'Echanges Scientifiques sur l'anacarde. pp : 21-31.
18. Samb, C. O., Touré, M. A., Faye, E., Ba, H. S., Diallo, A. M., Badiane, S., & Sanogo, S., (2018). Caractéristiques sociodémographique, structurale et agronomique des plantations d'anacardiers (*Anacardium occidentale* L.) du Bassin arachidier et de la casamance/Sénégal. Journal of animal & plant Sciences, 38 (3) : 6307-6325.
19. Samb, C. O., Diop, A. B., Mbaye, A., Sy, M., Cissé O., Faye E. 2024. Structure et composition floristique des plantations d'anacardier (*Anacardium occidentale* L.) suivant la toposéquence dans le département de Foundiougne (Fa-tick, Sénégal). *Revue Ecosystèmes et Paysages*. 4 (1) : 1-15.
20. Soto-Pinto, L., Perfecto, I., Castillo-H, J., Caballero-N, J. (2000). Shade effect on coffee production at the northern Tzeltal zone of the state of Chiapas, Mexico. Ag. *Ecosystem. & Env*., 80 : 91-69.
21. Tarpaga, V. W., Bourgou, L., Guira, M., Rouamba, A. (2020). Caractérisation agromorphologique d'anacardiers (*Anacardium occidentale* L.) en sélection pour le haut rendement et la qualité supérieure de noix brute au Burkina Faso. *International Journal of Biological and Chemical Sciences* 14 (9): 3188-3199. DOI : https://dx.doi.org/10.4314/ijbcs.v14i9.17.
22. Thiombiano, A., Glèlè Kakaï, R., Bayen, P., Boussim, JI, & Mahamane, A. (2016). Méthodes et dispositifs d'inventaires forestiers en Afrique de l'Ouest : état des lieux et propositions pour unr harmonisation. *Annales des Sciences Agronomiques* 20- spécial Projet Undesert-UE : 15 - 31.
23. Wala, K., Sinsin, B., Guelly, K. A., Kokou, K., & Akpagana K. (2005). Typologie et structure des parcs agro-forestiers dans la préfecture de Doufelgou (Togo). *Sécheresse,* 16 (3) : 209-216.
24. Yabi, I., Yabi, F. B., & Dadegnon, S. (2012). Agroforesterie à base de l'anacardier et dynamique de l'occupation du sol sur l'axe Agbass-Idajo (Région des monts Kouffé au Bénin). Revue de Géographie du laboratoire de Recherche sur la Dynamique des milieux et des Sociétés (LADYMES). Zones de cultures au Bénin. Agronomie Africaine, 26 (1) : 9-22.
25. Yoni, M., Senou, I., & Yonli E. Y., (2023). Caractérisation des Parcs Agroforestiers à *Anarcadium occidentale* L. et Services Ecosystémiques dans la Forêt Classée de Dindéresso à l'Ouest du Burkina Faso. *European Scientific Journal.* 19 (27), 203. DOI : https://doi.org/10.19044/esj.2023.v19n27p203.